

Interactive comment on “Modelling study of transformations of the exchange flows along the Strait of Gibraltar” by Antonio Sanchez-Roman et al.

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Firstly, we wish to thank the reviewer for his/her comments to our paper.

Detailed response to comments of referee#1:

Reviewer comment: I do not believe the explanation given at the top of page 16 for the recirculation of water from one layer to the other in the absence of tidal forcing. The explanation is that mechanical drag would explain the recirculation processes. This might be true in the hypothesis that a material surface separates the two layers, which is not true in this study. Furthermore, the exchanges inside the straits are so small to

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be almost insignificant.

Response: We respectfully disagree with the reviewer. It is not required to have a material surface separating the two layers to have a drag acting between the layers. The differences in velocity between the two layers induce a transfer of momentum that is equivalent to a drag force. This happens at tidal frequencies but also at low frequencies. We cannot univocally demonstrate our hypothesis but we do not have an alternative one, that is why we present it as a "possible explanation".

Reviewer comment: sections 4.1 and 4.2 could be shortened and synthetized.

Response: we honestly consider the discussion as the most important part of the paper, since it is where we compare our results with previous papers based on the traditional approach of a material surface separating Atlantic and Mediterranean waters. We are therefore reluctant to shorten sections 4.1 and 4.2; actually, subsection 4.1 has been enlarged in the new version of the manuscript, following the suggestions of reviewer#2 (she/he suggested to move some paragraphs and sentences from the results section to the discussion).

Reviewer comment: Equations 10 through 15 are cumbersome and distract the reader. I recommend putting them in an appendix and leave only a synthetic explanation in the main text.

Response: we thank the reviewer for her/his comments. However, we think that equations 10 to 15 are important to understand the procedure followed to parameterize the exchanges basing on the reconstruction of the recirculation fluxes in a first step, and subsequently on the estimation of the modification of the T/S properties of the incoming and outgoing waters at the eastern boundary of the Strait. Summarizing, we honestly think that the formulation should be kept in the main body of the manuscript.